



SECURITY CONCERNS + OF THE MEDICAL LABORATORY

Presented by Squiddy

ABOUT ME

I love volunteering!
BIOHACKING  **VILLAGE**



- **OSINT Enthusiast**
- **Professional Internet Yapper & Activist**
- **Medical Laboratory Scientist, MLS, MHIS**
- **Hacker, Artist, Small Business Owner,**

Blah blah blah..

SQUIDEYE

Small business in Champaign-Urbana, formed in February 2024. SquidEye is an electronics repair shop that aims to be affordable and accessible to the community. SquidEye functions as a queer-friendly space and mini-Makerspace. I'm willing to try to fix just about anything, so people bring me all sorts of tasks, problems, and questions. I've been asked to fix phones, toasters, plush toys, design websites, clean playstations, find deleted webpages, bait hackers, locate pedophiles with active arrest warrants, and catch scammers.

I've also been commissioned to light up some funky mushroom art, and I handled graphic design for this year's conference.

I've been shocked more times than I can count, grabbed a live wire and had my hair (eyelashes included) burnt off, accidentally set fire to things, been covered in broken glass, and nebulized after inhaling a fair bit of spray paint during an art escapade at 2AM.

I wouldn't change a thing, but my wife wants to ground me. ☹️



BIRD34TER

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I rent shop space at Bird34ter - a local, queer art studio and hair salon run by Xed ("Eddie") Boatz, AKA Bird34ter. The "pit" where hair-cutting transformation takes place is fidget-filled, and sensory-friendly.

Apart from being a very talented mixed-media artist, Xed does all sorts of amazing things with hair. If you're ever in Champaign-Urbana, come get the gayest haircut of your life while you check out their art.

Give them a follow on social media to support a small-business!



NO CRYING IN BLOOD
BANK, ONLY USE
APPROVED SALINE.

HA HA
HA HA
HA HA

Blood Bank

A LAB RAT



Eight years total of healthcare education and work.

B.S. General Health Science (IUPUI & IUK)

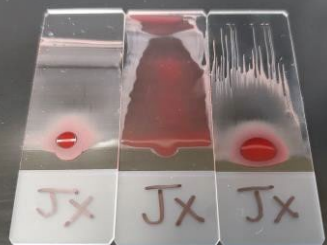
B.S. Clinical Laboratory Science (IUSB)

M.S. Health Informatics (IUPUI)

Focus:

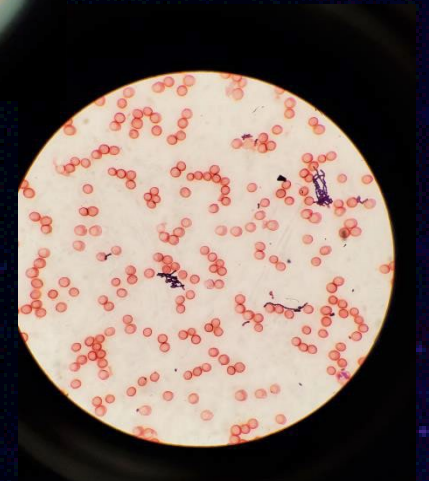
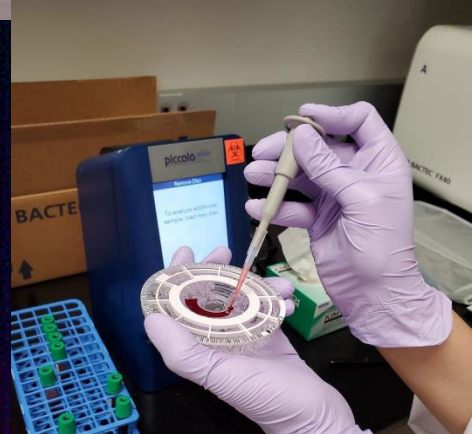
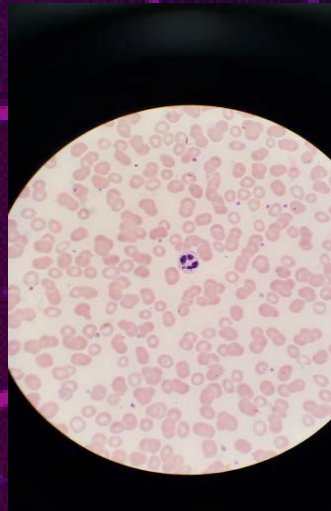
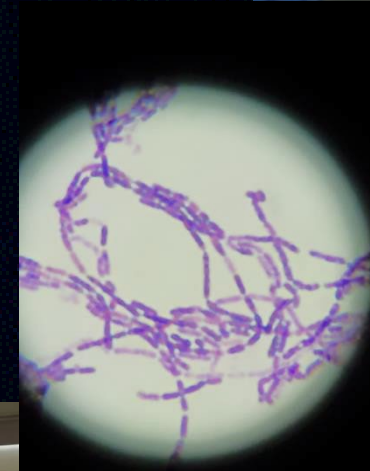
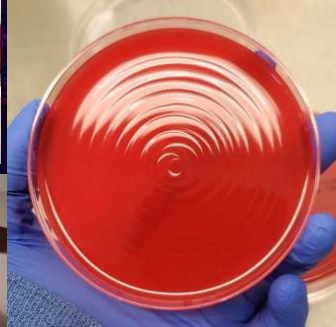
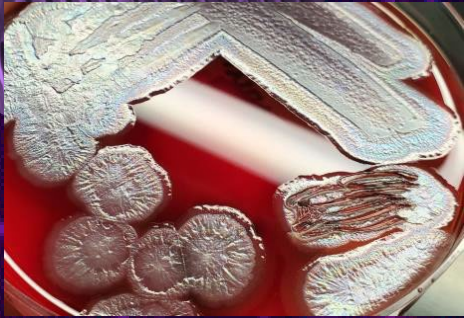
Health Information Security

Gender-Inclusive Care



LABORATORY SCIENTISTS

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LET ME CULTURE YOUR BACTERIA!!

THE LABORATORY ENVIRONMENT

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Multiple departments make up the medical laboratory including:

- Chemistry (thyroid + hormone tests, liver and heart enzymes, potassium levels, cholesterol)
- Immunology (study of immune products such as antibodies produced by the body in response to foreign material)
- Hematology (study of blood, blood morphology and blood diseases - think complete blood counts, and white blood cell count)
- Microbiology (where we culture samples for things like E.Coli, Salmonella, Staph Aureus, and Pseudomonas).
- Blood Bank (where we type your blood, blood products, and issue blood products for transfusion)

MEDICAL LABORATORY MEMBERS

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- Medical/Clinical Laboratory Scientists

AKA:

Medical/Clinical Laboratory Technologists,
Medical Laboratory Professionals Medical laboratorians

- Laboratory Technicians
- Laboratory Assistants
- Phlebotomists
- Senior Techs (heads of each lab section)
- Laboratory Director
- Laboratory Informaticists or LIS Specialists



Vera Z. Dwyer College of Health Sciences: Indiana University South Bend

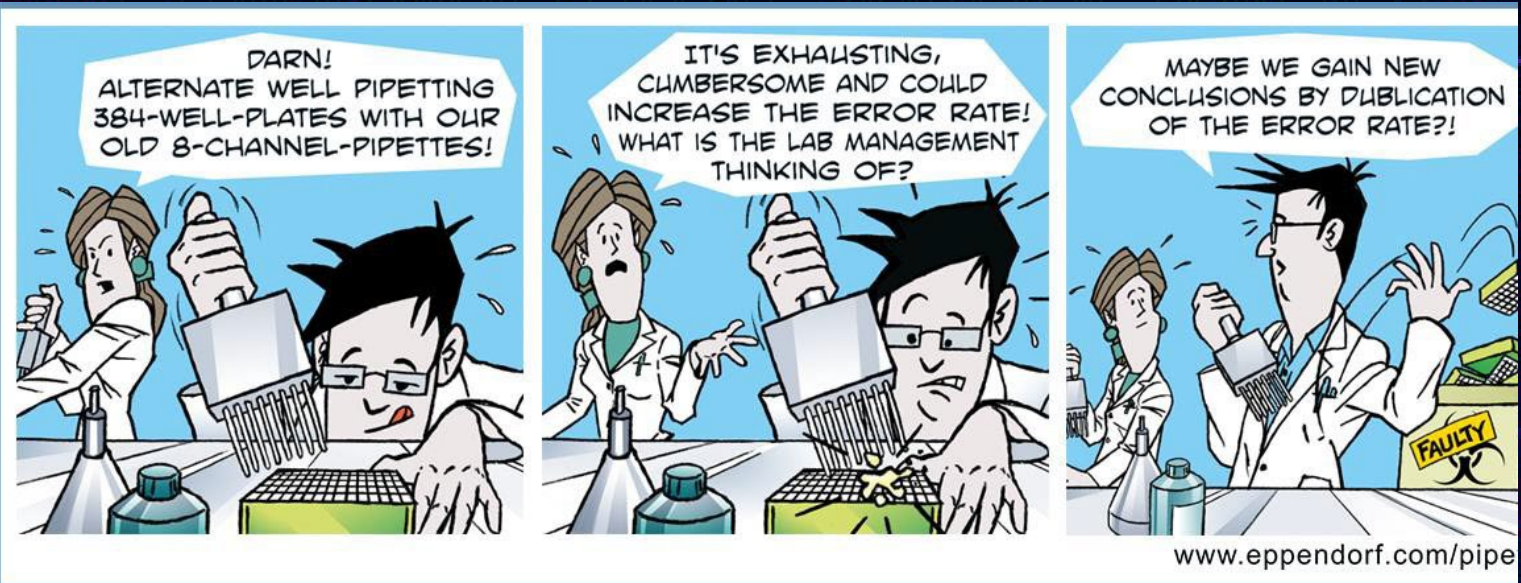
Other departments also reside in or near the lab in their own areas: such as Cytology, Histology, and Pathology.

WORKFLOW OF THE MEDICAL LABORATORY

Constantly navigating between multiple departments and performing complex testing that varies per department.

We must be able to start a test, move to another department or area to complete a test that may be STAT, and come back and finish the test we started without error.

It's busy, it's stressful, and it requires a lot of focus!!

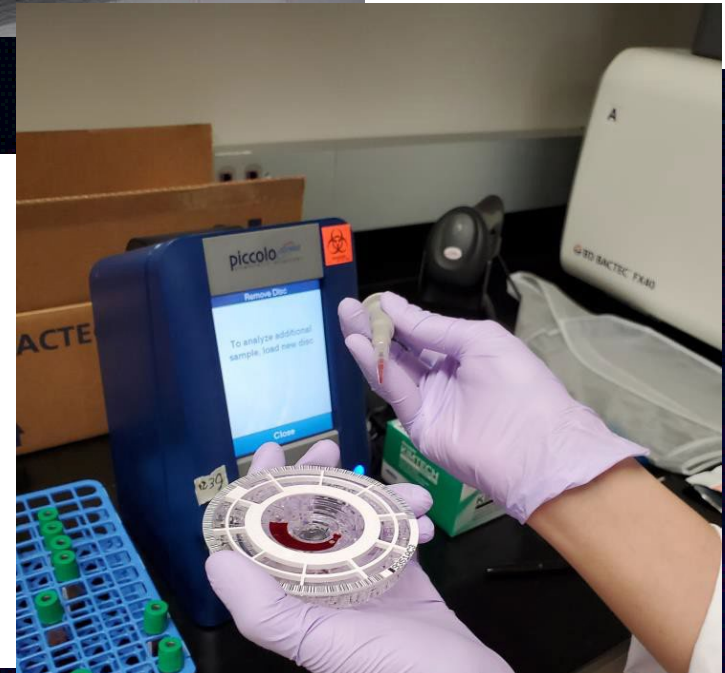


INSTRUMENTATION

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A MILLION MACHINES

HOW ARE WE REGULATED?

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“The Clinical Laboratory Improvement Amendments (CLIA) regulate laboratory testing and require clinical laboratories to be certified by the Center for Medicare and Medicaid Services (CMS) before they can accept human samples for diagnostic testing.” - U.S. Food and Drug Administration, 2022

Three federal agencies are responsible for CLIA

- The Food and Drug Administration (FDA)
- Center for Medicaid Services (CMS)
- Centers for Disease Control and Prevention (CDC)

Each agency has a unique role in assuring quality laboratory testing.

Data Transmission regulation:

Health Level Seven (HL7) refers to a set of international standards designed to facilitate the exchange of clinical and administrative health data between applications, with the goal of enhancing patient outcomes and optimizing the performance of health systems. - Think FHIR! FHIR defines how healthcare information can be exchanged between different computer systems regardless of how it is stored in those systems



INSTRUMENT COMMUNICATION AND DATA TRANSMISSION

Health Information System (HIS): A system that manages Healthcare Data. Examples include electronic health record (EHR) systems, Laboratory Information Systems (LIS), and Radiology Information systems (RIS).

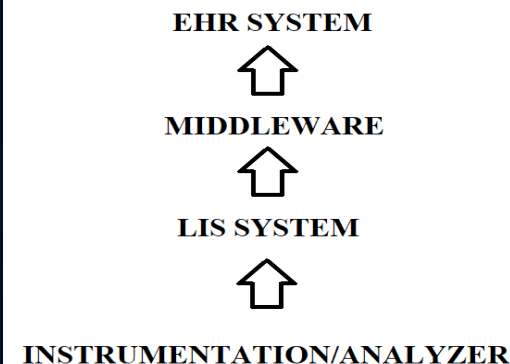
Data flows across multiple health information systems which together form a web that is used to manage patient data.

Interoperability is key!

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- Analyzer Data (Various analyzers in different lab departments)
- LIS (Cerner, Softlab, EPIC Beaker, Meditech)
- Middleware (CLOVERLEAF, RALS) - maps data
- EHR System (EPIC, CareCloud, AllScripts)



WHERE DOES MY DATA GO?

Health Information System (HIS): A system that manages Healthcare Data. Examples include electronic health record (EHR) systems, Laboratory Information Systems (LIS), and Radiology Information systems (RIS).

Data flows across multiple health information systems which together form a web that is used to manage patient data.



LABORATORY INFORMATION SYSTEM (LIS) VS LMS

Sometimes used interchangeably; the two overlap but were designed to support different laboratory types and functionality.

Laboratory Information System (LIS):

Patient-based; for processing and reporting data for individual patients in a clinical setting

Laboratory Management System (LMS):

Sample-based process; report data related to batches of samples

LIS and LIMS overlap such that distinctions have become harder to make, but their overall initial purpose for development remains the same.

DATA TRANSMISSION ERRORS

Transmission errors such as a patient demographic mismatch can delay patient care, lead to information being merged to the wrong patient chart, result in incompatible blood transfusions, errors in medication administration, and erroneous diagnostic lab results.

These errors can result from: entry mistake, updates to existing information, analyzer malfunction

Example:

Patients who change their sex may be more likely to experience a delay in care related to a demographic mismatch. A mismatch may be intentional for insurance purposes (Allison et al., 2021). This is why we advocate for gender inclusive features in healthcare systems, and push for them to be incorporated every step of the way, from the laboratory to the patient's chart!!

VULNERABILITIES OF THE MEDICAL LABORATORY

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1. Physical access to the laboratory computers, servers, or instrumentation,
2. The variation in instrumentation and how they each handle transferring patient data,
3. Transmission errors that occur in the HIS as result of human data entry data,
4. The Humans!

OH, THE HUMANS

Tailgating, shoulder-surfing, and social engineering

A badge required to access the lab, and a password required to access the computer terminals in the lab is not enough.

Single Sign-on can be a blessing and a curse. The same user password for computer and network login being used to access the analyzers and applications that contain patient data might not be the best thing. You can restrict access fast, but patient information can be stolen and leaked fast, all in one login session.

The constant workflow and movement of techs between computers and the flow of works in and out of the laboratory.

Physical access to computers with USB ports if tailgating occurs, these terminals also exist in every patient room and are often left unattended.

Ability to plug in devices that you bring from home without having the devices screened.

No camera surveillance in the lab or certain patient areas - surveillance can itself result in a HIPAA violation.



Surprise! The biggest threat is people.

PATIENT PERSPECTIVE: WHY SHOULD I CARE?

THAT'S **YOUR** DATA!

That is your SSN! Your date of birth! Your address! Your test results and the information they contain, sensitive and deeply personal medical history including test results saying you are positive or negative for something and *sometimes that information is a test result for HIV or a positive cancer diagnosis. Some of these results may be obscured or have additional measures in place to protect them from being visible to anyone in your chart, but that information can be obtained if attackers have enough of your information to impersonate you!*

That is your medical history sometimes spanning throughout your entire life, and provider notes can contain detailed information - concerns regarding your mental health, and in-depth conversations you have with your medical provider.

WHAT CAN I DO?

See something, say something! Report it to the hospital - **in writing!**

Come join the lab! We need more security-oriented minds, we need more scientists, and we need security warriors willing to protect patient data. We need more people who care enough **and** who possess the **background** to understand the healthcare workflow.

If you work in cybersecurity at a hospital, including a facility with a medical laboratory - get to know us! We want your data to be safe, too. Educate our workers on security and get them to pay attention by speaking their language!

Learn about the various unique threats to patient data and hospital systems - don't just focus on things like ransomware attacks.

CITATIONS

Allison, M. K., Marshall, S. A., Stewart, G., Joiner, M., Nash, C., Stewart, M. K.(2021). Experiences of transgender and gender nonbinary patients in the emergency department and recommendations for healthcare policy, education, and practice. The journal of Emergency Medicine, 61(4),396-405. doi: 10.1016/j.jemermed.2021.04.013

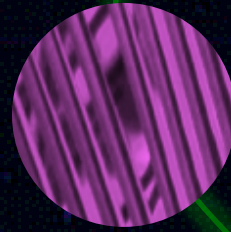
Centers for Disease control and Prevention (2018, November 15). Strengthening clinical laboratories. <https://www.cdc.gov/csels/dls/strengthening-clinical-labs.html>

Centers for Medicare & Medicaid Services (2022, August 2). Clinical laboratory improvement amendments (CLIA). <https://www.cms.gov/Regulations-and-Guidance/Legislation/CLIA>

U.S. Food & Drug Administration (2021, September 13). Clinical laboratory improvement Amendments. <https://www.fda.gov/medical-devices/ivd-regulatory-assistance/clinical-laboratory-improvement-amendments-clia#:~:text=The%20Clinical%20Laboratory%20Improvement%20Amendments,human%20samples%20for%20diagnostic%20testing>.

Orchard Software (2021, November 2). What is the difference between an LIS & a LIMS? <https://www.orchardsoft.com/blog/what-is-the-difference-between-an-lis-a-lims/#:~:text=The%20Main%20Difference%20Between%20the%20LIS%20%26%20LIMS&text=The%20biggest%20distinction%20is%20that,individual%20patient%20identities%20are%20unimportant>.

THANK YOU



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